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Cooling System Service

by G. D. McCORMICK

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The season is at hand when automobiles, trucks and buses operating in the frost belt will be prepared for Winter driving. One of the important and essential Winter service operations is the installation of anti-freeze to protect the cooling system from damage by freezing and rust formation. Contrary to the opinion held by many, the servicing of the automotive cooling system for anti-freeze may consist of more than simply draining out the water and adding anti-freeze. It is understandable that when anti-freeze installation is delayed until the first freeze-up rush, an abbreviated procedure such as that just mentioned has to be followed. However, where anti-freeze selling is started early, there is ample time for the service attendant to perform the other necessary servicing which is usually required by any piece of automotive equipment that has been in use for longer than a very brief period.

The National Carbon Company, Inc., through the medium of its research laboratory and field organization experience over the last ten years, has found that the expenditure of a little additional time, effort and cash, before anti-freeze installation, makes a decided difference in the performance of a piece of automotive equipment during the Winter months. The most essential requirements for satisfactory performance of a cooling system are that it be clean, leak-tight and in proper working order. The dealer or service man whose business it is to sell and install the anti-freeze can always determine by examining the cooling system, just what the necessary service operations will be, and should sell these services to the owner of the car, truck or bus.

Field investigations have revealed that the principal causes of cooling system complaints arise from neglecting essential service operations, like tightening the cylinder head studs to make sure the cylinder head joint is water-tight; cleaning and pressure-flushing the cooling system to remove clogging material in the radiator, engine block and heater; inspecting the water pump to make sure there is no leakage around the seal and along the shaft; prevention of corrosion to the cooling system metals during the months when a treated anti-freeze is not used, and periodic replacement of radiator and heater hoses. The normal destructive processes of nature are always at work in the cooling system to create the conditions just described. Many successful dealers make a practice of performing essential services like cleaning and pressure-flushing the cooling system, repairing water pumps, tightening cylinder head studs, checking thermostats, and replacing deteriorated hoses and fan belts. By performing these services they are able to show a nice profit for their time and effort.

Many dealers pass up cleaning and pressure-flushing cooling systems because they are not equipped to perform this particular type of service. A dealer who has a wash-rack or similar space available, and can pipe air and running water to the space, can, with the expenditure of only a few dollars for a flushing gun, equip himself to perform a service operation that will return a profit that is commensurate with the profit that is received from other service operations. It is important to remember that the radiator, engine block and heater should be flushed in the opposite direction to normal flow first, after which they should be flushed in the direction of normal flow. Pressure-flushing is *absolutely necessary* for corrective cleaning of very dirty or clogged radiators. Many car manufacturers recommend that cooling systems be cleaned and pressure-flushed twice a year, in the Spring and Fall, or every 6,000 miles.

After the cooling system is cleaned, it is well to make an inspection of the water pump, thermostat and fan belt, to see that they are in proper condition or working order, and also to check the radiator hoses, drain cocks and cylinder head joint to be sure that they are leak-tight. The anti-freeze should then be installed in accordance with the printed directions supplied by the anti-freeze manufacturer, taking care to run the engine long enough to open the thermostats to permit the escape of trapped air in the top of the engine block. An important item to remember is that many serious Winter crankcase problems are caused by the accumulation of crankcase condensation. This accumulation is formed from condensed water vapor and exhaust gas blow-by from the combustion chambers, since over a gallon of water is formed from the burning of a gallon of gasoline. Much water vapor blows by the piston rings during the warm-up period. In many cases serious corrosion and etching take place on the finished surfaces of the pistons, connecting rods and

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Technical Data

PRECISION-KNOPF CHANNEL TEST FOR GEAR LUBRICANTS

There is no ambiguity in the definition that describes channel as being a groove or furrow; however, when a gear lubricant is said to channel in an axle housing, seemingly few comprehend the significance of the condition, or know just what is taking place within the housing.

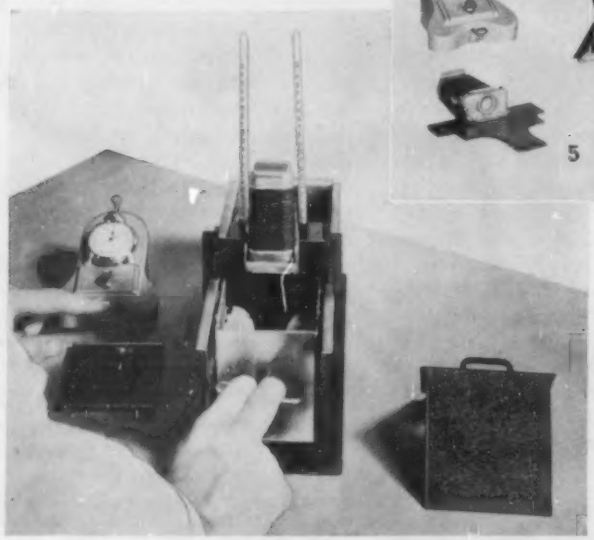
It has been pointed out that the S. A. E. handbook in specifying gear lubricants calls for certain Furol viscosities at high temperatures; and consistencies at low temperatures of such value that the lubricant will not channel at the given temperature, each grade having its own limits. No attempt is made to define channel or describe a condition known as channel in service. Occurrence of channel may sometimes be made known by gear hum or grind, or by actual failure of gears; but the proper course to follow is to use only lubricants that are safe at operating temperature, the channel property being determined by some practical, as well as accurate laboratory test. The inadequacy of the ASTM pour point method is acknowledged by the S. A. E. in the following quotation from the handbook: "The pour point of a gear lubricant is of little or no importance in determining whether the lubricant will feed satisfactorily to the ring gear and pinion and not channel at low temperature."

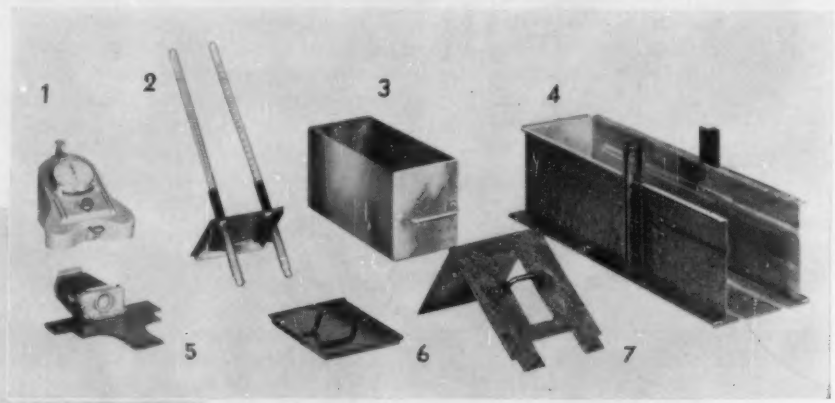
The low temperature consistency of the lubricant is determined accurately by the "Spike Test" method fully described in an A. P. I. paper, Dec. 1928, and in the Industrial and Engineering Chemistry, March 15, 1934, the former giving details of correlation with axle test.

The other test simulates the condition existing in a rear axle housing when a cold lubricant feeds to the ring gear at such a slow rate that the tooth surfaces are improperly lubricated. The sample employed in this test is about 1.5 pints, or half the quantity used in the axle housing of an average car, and nearly eighteen times the insignificant sample used in the pour-point test. A few simple basic principles are involved: first, the size and general dimensions of the sample must be comparable with the lubricant in the car axle, since fluidity is greatly affected by size of container; secondly, a channel must be cut through the lubricant leaving two walls of fixed height, free to flow toward each other at a rate dependent upon the consistency or fluidity of the sample at the test temperature; thirdly, it should be noted that a certain amount of agitation is given the sample, simulating that produced by the ring gear teeth when rubbing against the channel; lastly, and of much importance, is the fact that a series of determinations, consisting of six or more readings, may be obtained in the course of a day with the expenditure of relatively little time. The value of viscosity-temperature curves is well known, and, after careful consideration, fluidity-temperature curves also should be appreciated. The channel properties of lubricants, especially for hypoid gears, must be known otherwise frequent failures may be experienced.

The Pan Channel Test requires only a few simple parts, as shown in the accompanying photograph of the preliminary instrument. The test does not necessarily require special aerating equipment, since aeration has only to do with the preparation of the sample and is no part of the channel test. The samples may be aerated before making the channel test; however, results closely agree with those obtained on original sample, so aeration is unnecessary.

Except for research study, we believe that channel tests on aerated samples are unimportant and not necessary. Deeper pans and long blades, necessary for aerated samples, can be supplied upon request.





1. Stopwatch in holder.
2. Rear cover for sample tray; with thermometers.
3. Sample tray.
4. Housing.
5. Channelling plate with flash-light.
6. Front cover for sample tray.
7. Housing cover.

Procedure

Although ordinarily several samples are run at the same time, this description is based upon one sample only. The sample is placed in the pan to a depth of 2″, lid put on, thermometers adjusted so bulbs will be 1″ from the bottom of pan. Place the pan, housing and blade in a suitable refrigerating cabinet. For winter lubricants a minimum temperature of minus 30° F. is recommended. A small electric fan is desirable for controlling the temperature of the pan subsequent to the first channel determination following the over-night cooling of the sample; however, the fan is not necessary during the night.

The thermometers are read before removing the lid. The pan is then placed at the back of the housing, blade inserted in the slotted posts which hold it in a fixed vertical position just inside the pan. The lamp is now attached to the blade and switched on.

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crankshaft. Much of this can be prevented by the use of thermostats that are set to open at 160 degrees Fahrenheit or higher.

The use of 160 degree thermostats is recommended for Winter operation because of the serious blow-by and contaminating condition just described. Another advantage of the 160 degree thermostat is the beneficial effect on engine operation, because with this elevated temperature there is more power from the engine, less corrosion and wear of moving parts, less gasoline consumption, less thinning of lubricating oil by unburned gasoline, less carbon formation in the engine, as well as less sludge formation in the lubricating oil.

Quite frequently the question is raised regarding the saving of an anti-freeze solution from year to year, or the advisability of driving with it all Summer. Our recommendation in these cases is to drain and discard all anti-freeze solutions after one Winter's use for the same reason that old crankcase oil is discarded, that is, impurities can collect in an anti-freeze solution too.

High-Lights of the 1939 Models

by J. HOWARD PILE
Editorial Director of Chek-Chart

The following is a brief outline of principal changes that would normally be of interest to the service man:

AMERICAN BANTAM. Continuing the Model 60, with no important mechanical changes.

BUICK. Model names same as 1938. The cars are radically changed in appearance and have many new mechanical features. One thing that the service man will have to be on the lookout for is the new center bearing on the propeller shaft. This is mounted to the frame and while suspended in rubber, has a lubrication point at the joint. This appears on the 40 and 60 models. The automatic transmission, carried as optional equipment on the 40 in 1938, has been dropped. The clutch equalizer shaft, previously found only on the Model 40 and lubricated from under the hood, is now found on all models and is lubricated from underneath the car.

CADILLAC. The line consists of three V-8 models and one V-16. One of the V-8 models—the new 61—is an entirely new addition to the line, and has many new features. Wax lined springs are continued.

CHEVROLET. Models are the Master and the Master De Luxe. The De Luxe uses the new Double A frame type of knee-action, which replaces the Dubonnet combined spring and shock absorber used on previous models. Hypoid gears are retained.

CHRSYLER. Models are the Royal C-22, the Imperial C-23, and the Custom Imperial C-24. Transmission overdrive is either standard or optional equipment on the various models.

DE SOTO. The transmission overdrive has been redesigned and now cuts in at 25 m. p. h. instead of 35 m. p. h.

DODGE. The most striking design change in this line is the use of independently sprung front wheels.

FORD. In addition to the Ford V-8 models, an entirely new model—the Ford Mercury—is added to the line, this having a larger engine and many other new features. In design and price it comes in between the Ford and the Lincoln Zephyr. Hydraulic brakes are to be a feature of the 1939 Ford line.

GRAHAM. The model names and the general features are not greatly different from the 1938 line. The models are the Special (96) and the Supercharger (97). A number of minor mechanical improvements have been made.

HUDSON. The 1939 line now consists of four models, of which the 112 and the 6 are the junior line, and the Country Club 6 and Country Club 8, the senior line. The new 6 takes the place of the previous Terraplane and the name "Terraplane" does not appear in the 1939 set-up. Many mechanical and design features are to be found.

HUPMOBILE. The 6 (E-922) and the 8 (H-925) are continuations of the previous Hupmobile line, but are radically changed in outside appearance. A new low priced 6 is also added to the line and the company contemplates bringing out an entirely new four cylinder model later on.

LA SALLE. This is continued with one single model —the 50— which has been improved and changed in many respects. Rubber has been used in a good many places, eliminating previous lubrication points. Extreme care needs to be taken with the lubrication of some of the engine accessories, such as the starter, which are somewhat inaccessible from above.

LINCOLN. The big Lincoln is continued without extensive changes and occupies its usual conservative position in the automobile industry. Mechanical brakes are retained on this car.

LINCOLN ZEPHYR. A style leader in 1938, this car has gone still farther forward and has also incorporated a number of radical mechanical changes, among which may be mentioned the use of hydraulic brakes and also the use of expanders under the two lower piston rings.

NASH. The Nash line for 1939 will consist of the Nash Lafayette and the Nash Ambassador models. Cruising gear is retained with improved features, and Nash is employing the Weather Eye conditioned air system on the Ambassador models.

OLDSMOBILE. Models are the F60, G70 and L80. Coil rear springs, previously found only on Buick cars, are used. There are a number of other design changes, including layout of the steering parts.

PACKARD. The new models are the Six, the 120 (previously called the Eight), the Super Eight and the Twelve. One very interesting departure is the use of a fifth shock absorber on the rear equalizer bar—the first time this has ever been used in American automobile practice. Transmission overdrive is being used for the first time on Packard models, being available as optional equipment on all except the Twelve.

PLYMOUTH. There are two models, the Roadking and the De Luxe. The De Luxe model has the gear shift lever on the steering wheel, and both models have the new type independently suspended front wheels, which is a new departure for Plymouth.

PONTIAC. Previously, Pontiac had two models—the 6 and the 8. This year there is an additional six cylinder model. Two mechanical features worthy of note are the use of Hypoid gears for the first time and the new type variable rate rear spring.

STUDEBAKER. The models are the Commander and the State President. The Planar front suspension is continued, but with a considerable number of changes in the lo-

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Being in readiness with the stopwatch, the pan is pulled forward with a quick steady pull (½ to 1 second) until the pan reaches the stop at front of housing, (travel 4") at which instant the watch is started. Close observation of the channel walls will show movement toward each other, the rate depending upon the fluidity of the lubricant at that temperature. Note that the blade not only fixes the head at 2⅜" on each side, but also chamfers the edges of the furrow to prevent the flowing-in of lubricant at the top of the groove, which would otherwise obstruct the view of the operator and prevent accurate timing of the closure. The walls come together at a point about 1" from the blade and about ¾" from the bottom of the pan, which has been scraped clean by the blade during the forward shift of the pan. The seconds time moving ½" is recorded as the "closing time" and is a measure of the fluidity; the shorter the time the greater the fluidity.

Immediately after the channel has closed the lamp is switched off and removed. The blade and pan are then withdrawn and the portion of the sample that was pushed forward is returned to the furrow with the least amount of agitation given to the side walls. With the lubricant again level in its pan, the blade is now wiped clean and put aside to cool off for the next test, to follow in an hour or so.

Likewise the lid is replaced on the pan, this time with the thermometers at the other side so that the reverse end of the sample may be channelled for the next determination.

Plotting six or eight readings (seconds vs. temperature) produces a valuable piece of information regarding a lubricant. A comparison of various curves shows clearly how greatly lubricants can vary; some curves are relatively flat, while others are quite steep and possess knees. The temperature at which a curve crosses the 20-seconds ordinate is recorded as the channelling temperature. Correlation with axle tests shows it to be about the same temperature at which there is a noticeable increase in heating rate. Also at that time more lubricant can be seen to feed to the ring gear; more appears in the mesh and on the pinion. Many axle tests in the cold room, as well as service experience, confirm the selection of the 20-second closing time. Likewise, it has been found that the "Spike Test" method gives practically the same results as the Pan-Channel test, differing by only 1 or 2 degrees ordinarily. The 20-second closing time occurs at the same temperature at which the "Spike" consistency is 12 ounces.

The Consadometer is a device employed in the determination of adhesiveness, and of consistencies of various types, including the "Spike consistency." This machine is manufactured by the Percision Scientific Company. Those who are not fortunate enough to own a Consadometer may still be able to measure the channel characteristics of lubricants by employment of the Pan-Channel device. They can be assured of acccurate determinations; a means by which fluidity-temperature curves can be drawn for various lubricants; and a method that simulates the condition existing in an axle housing when there is danger due to thickening of lubricant at low temperatures. We feel sure that when this device has been tried out its true worth will be appreciated.

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cation and number of lubrication points. The battery has been moved up under the hood.

WILLYS. An entirely new Willys has been designed, with many changes both mechanical and style, but with the ultimate idea of an economical car in the lowest price class.

Car models for 1939 probably have more style changes than any array of new models in the past score of years.

Probably the most general swing in design is that of the gear shift lever from its customary floor position to a position on the steering wheel column, immediately beneath the steering wheel itself. This was seen on a very few models in 1938, but is now found as either standard or optional equipment on all but a very few of the 1939 models. In practically every case a change in location of the gear shift lever is accompanied by a movement of the parking brake lever to a position on or under the dash.

Hypoid gears retain their popularity with the designers, and all cars which had them in 1938 continue to feature them in 1939. In addition, Nash, Pontiac and Oldsmobile have swung over to Hypoids this year, leaving only American Bantam, Ford, Hudson and Willys as the remaining users of spiral bevel gears.

Hydraulic brakes have made further advances, being used on the Ford models, the new Ford Mercury and the Lincoln Zephyr; but the big Lincoln continues to use mechanical brakes. This brings the hydraulic brake into almost universal use, as only two or three makers still continue the use of the mechanical type brakes.

Individually suspended front wheels take another jump forward in popularity in 1939, after having reached a hesitating point in 1938 models. Plymouth and Dodge have gone over to this type of front suspension. Chevrolet has adopted the Double A frame type of knee-action.

Among the front wheel suspensions, it is to be noted that some models are making greater use of either natural or synthetic rubber at some of the points, which either eliminates previous lubrication points, or makes a shift in the points to other places. The LaSalle, for instance, uses live rubber at four points at the inner ends of the lower control arms, which eliminates four points of lubrication. Studebaker is making extensive use of Neoprene, which is a synthetic rubber made by the DuPont people. This type of synthetic rubber is not harmed by oil or grease, as is the case with natural rubber.

The general line-up of car models is not greatly different than for 1938, with the exception that some of the car makers carry additional chassis lines. This is noted in the case of Oldsmobile and Pontiac, which have added an additional six-cylinder model to the line, to supplement the 6 and 8 that are continued with many changes from the previous year, and also in the case of Hupmobile, which has added a new lower priced 6.

In the Hudson line, the set-up is shifted around considerably, due to the fact that the "Terraplane" name is now being dropped. The line consists of the 112, the 6 (which was previously the Terraplane), and both a 6 and an 8 Country Club which are the larger models of the line.

Car suspension has received a lot of attention from designers. Oldsmobile now uses coil rear springs, which heretofore were used only by Buick.

Steering gears show evidences of a great deal of design and research, and many entirely new plans are worked out to contribute to easier steering and longer life of the parts. Many of the General Motors cars show entirely new set-ups in steering gear members, particularly the Pontiac, which has a new type drag link suspended on the right side from a dummy Pitman arm, and the Studebaker, which has an entirely new set-up with equal length arms on each side.